

Geochemistry Task

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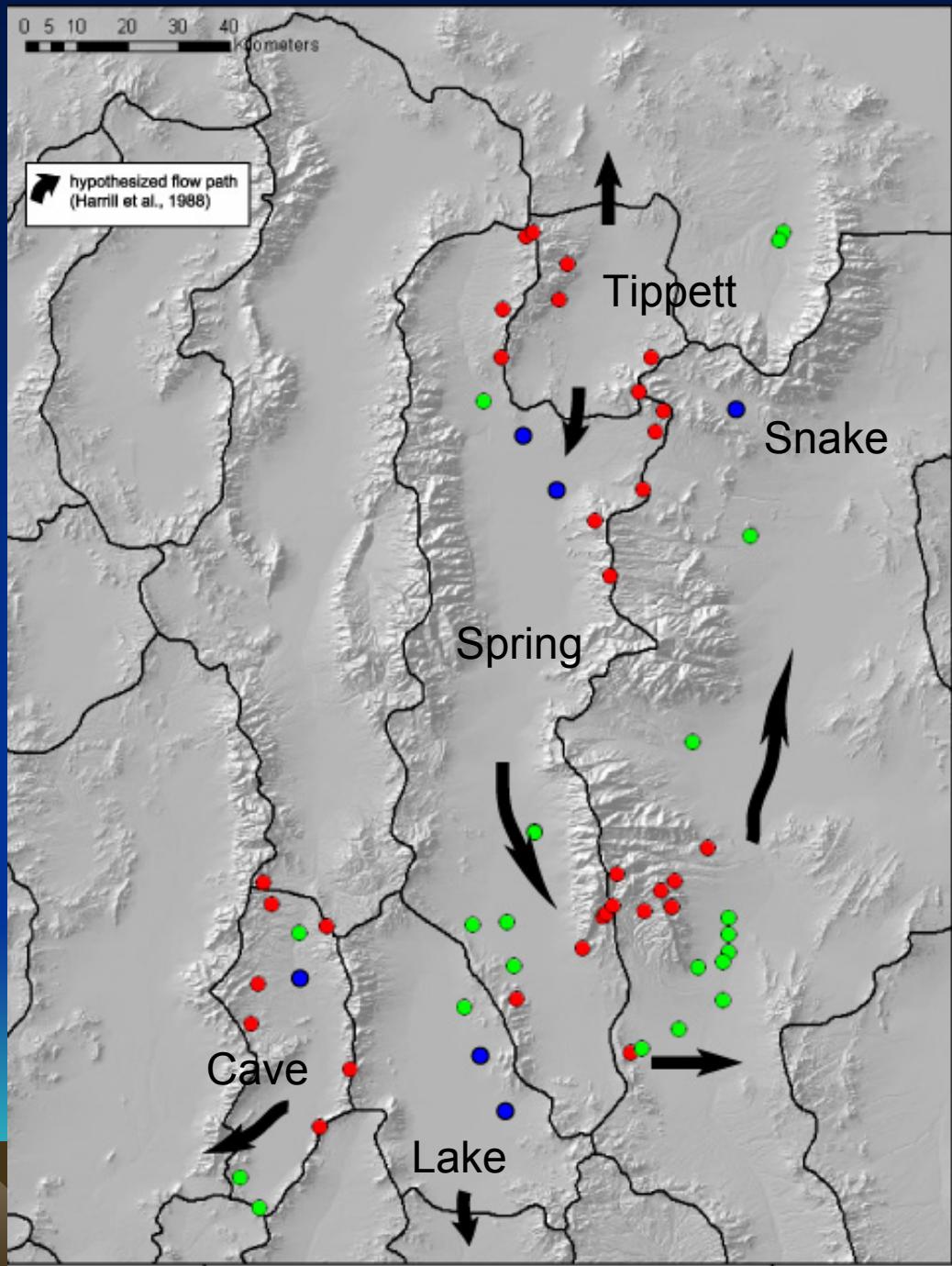
Outline

- task goals
- task progress
- task products

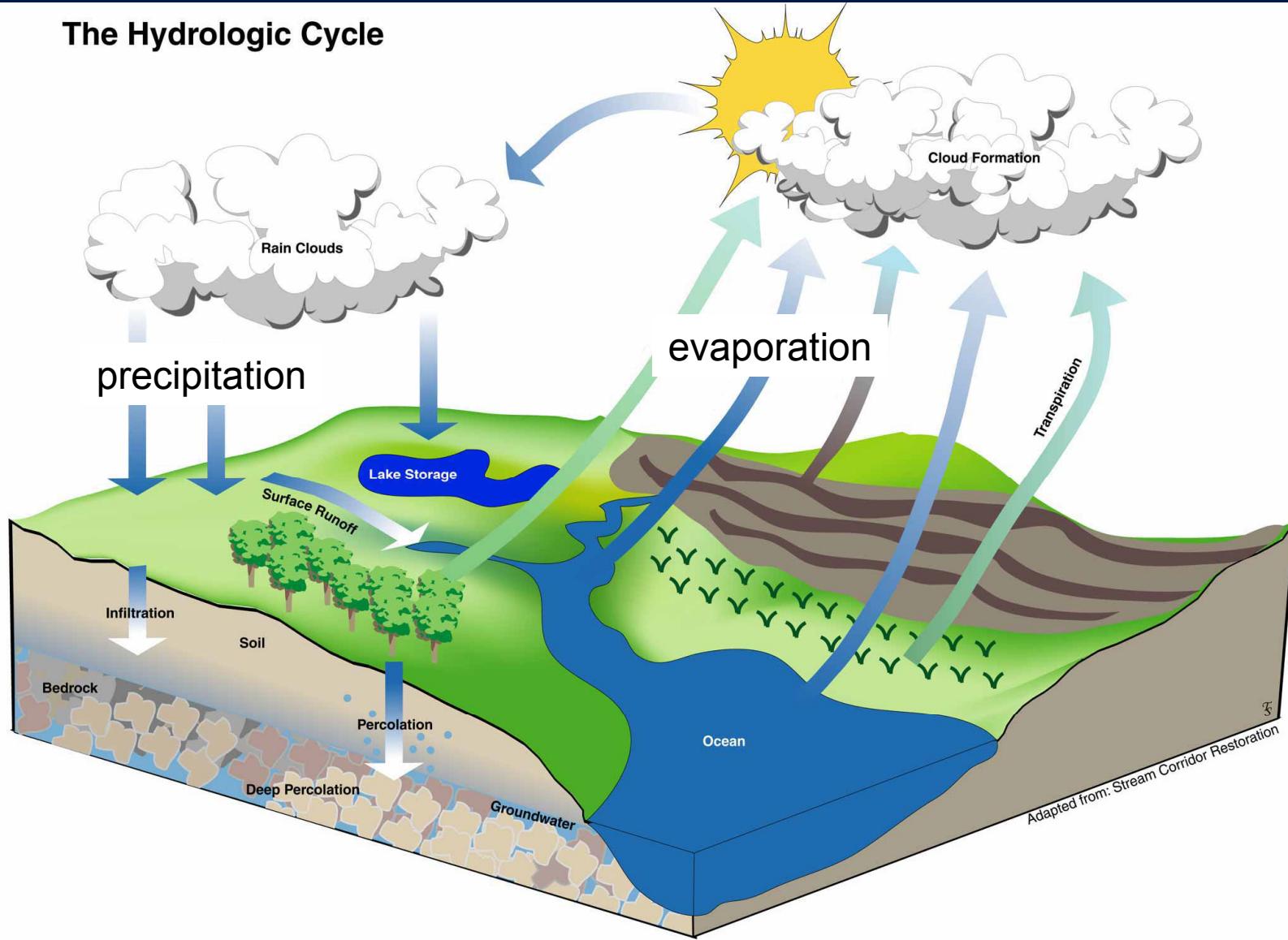
Task Goals

- principal ground-water flow paths
- ground-water recharge source areas
- ground-water travel times
- water quality





The Hydrologic Cycle



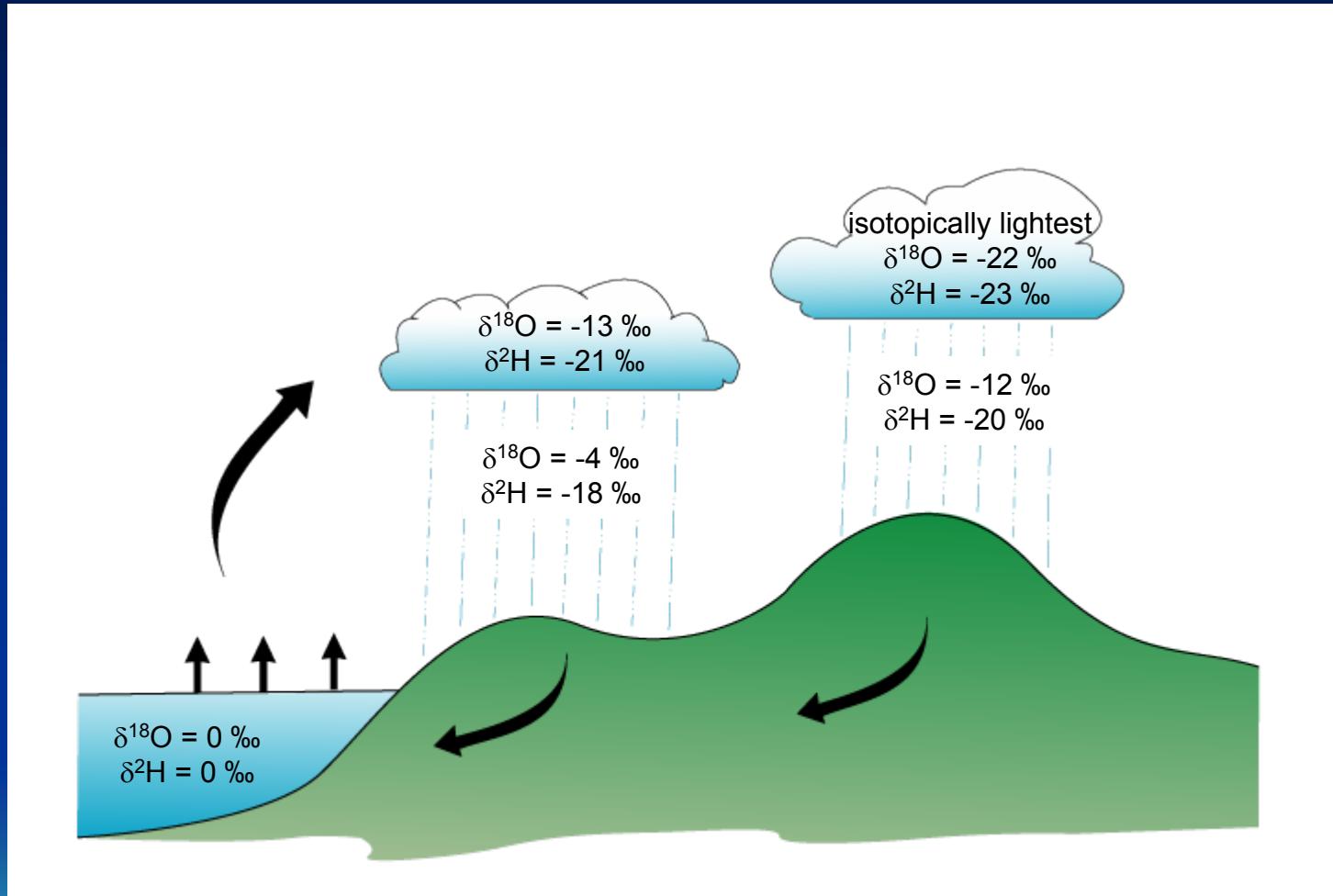
chemical analysis of ground water used to track its evolution along flow path

lithology determines ions available for reactions



constrains flowpaths, where did the water come from?

D/H and $^{18}\text{O}/^{16}\text{O}$ ratios in precipitation vary according to elevation and distance from the ocean



constrains recharge source areas, flow paths

Carbon-14

Carbon-14 produced when cosmic rays bombard nitrogen in the atmosphere

Carbon-14 combines with oxygen to form carbon dioxide in the atmosphere

Carbon dioxide incorporated into rain water

Carbon-14 decays at a known rate, this rate lets us determine the age of the groundwater

tritium is another technique that will “check” carbon-14

constrains groundwater age and, therefore, travel time

Analyses

WQ parameters	temperature, pH, electrical conductivity, dissolved oxygen	water quality
Major ions	Ca, Mg, Na, K, HCO ₃ , Cl, SO ₄	water quality, flow-path modeling
Isotopic tracers	² H/ ¹ H and ¹⁸ O/ ¹⁶ O	flow-path modeling, recharge source
Carbon isotopes	¹³ C/ ¹² C and ¹⁴ C	flow-path modeling, gw velocity
Dissolved gases	He, Ne, Ar, Kr, Xe, and ³ H	recharge source/rates

Task Progress

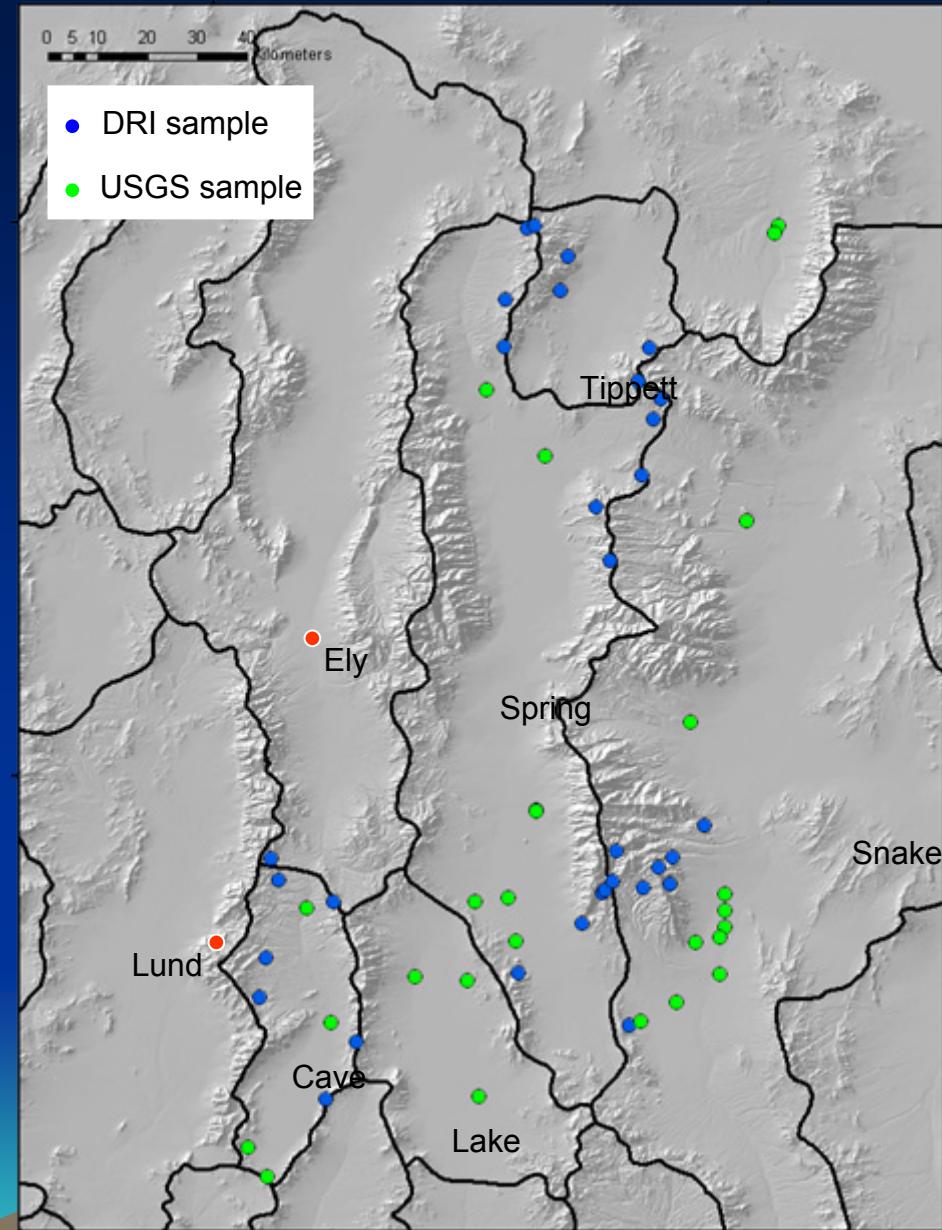
- springs and well samples collected
- sample analysis
- date base development
- modeling



Sampling

64 samples
collected for
analysis

- upland springs
- local springs
- valley springs and wells



Data Compilation

Add water-quality data to USGS NWIS

- new data generated during this study
- historical data

Carbonate aquifer Schaefer, Wood, and Williams (2003)

Springs Pupacko, Wood, and Williams (1989)
 Thomas et al. (2004)

Springs/Wells Hershey and Mizell (1995)

Task products

- primarily a support task
- could produce water-quality maps, flow-path maps
- ground-water ages and travel times

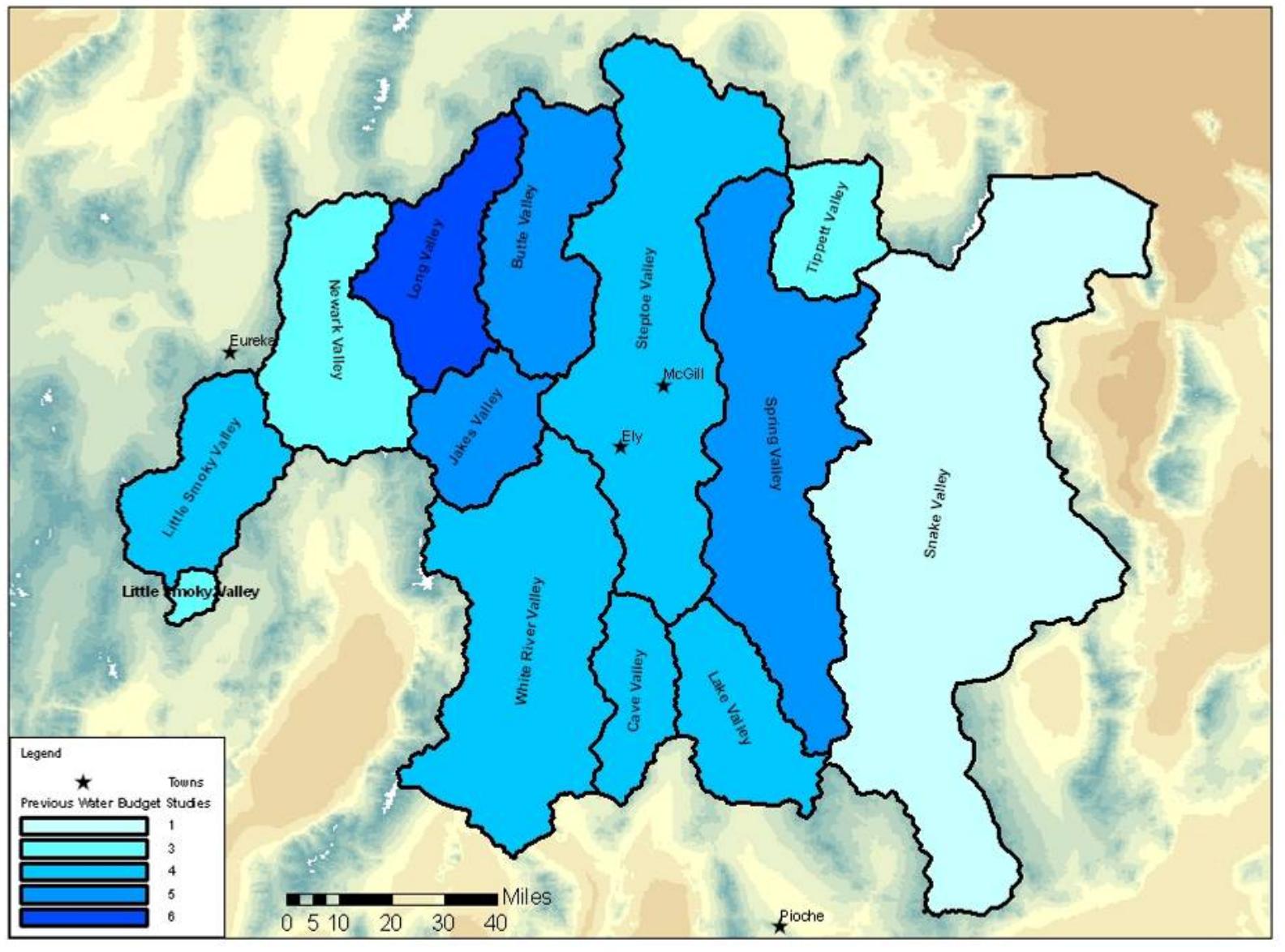
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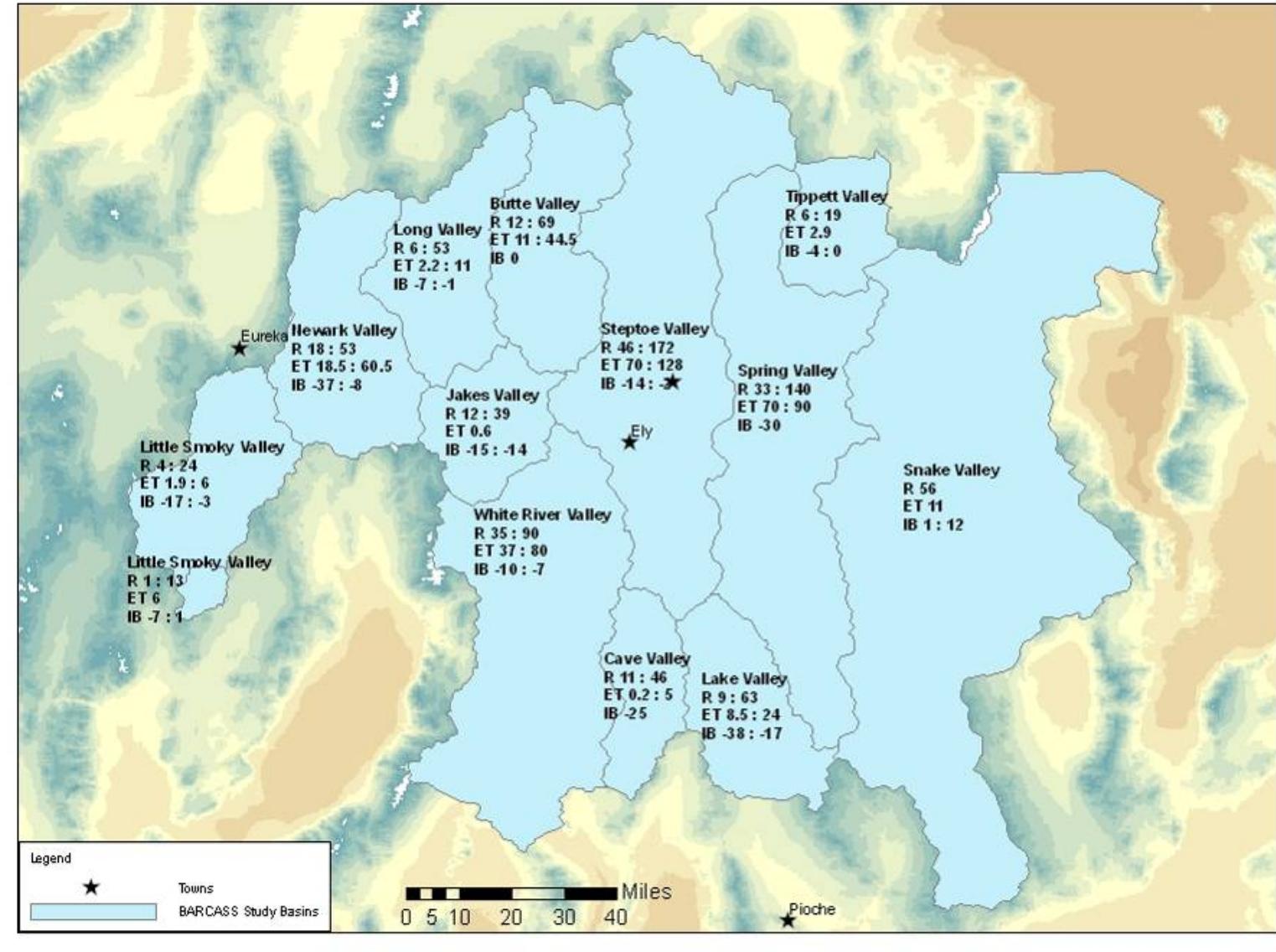
- Task objectives
- Assessment of previous water budget estimates
- Water accounting model



Task Objectives

- Compile previous water budget estimates
- Develop new water budget estimates from the recharge, discharge, and interbasin flow tasks
- Develop a water accounting model
- Quantify the water balance uncertainty





Water Accounting Model

- Other tasks will estimate various components of the water budget
 - Natural recharge
 - Evapotranspiration
 - Springflow
 - Interbasin flow
 - Pumping
- The inputs and outputs will be sampled within pre-specified ranges and then individual components will be adjusted to balance the accounting model



Water Accounting Model

- Incorporate other data such as geologic, hydrologic, and geochemical information to constrain individual basin estimates
- The level of uncertainty in the accounting model predictions will be evaluated using statistical techniques
- The process will highlight a limited set of probable water balance models

